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COAL DEPOSITS
In Montana

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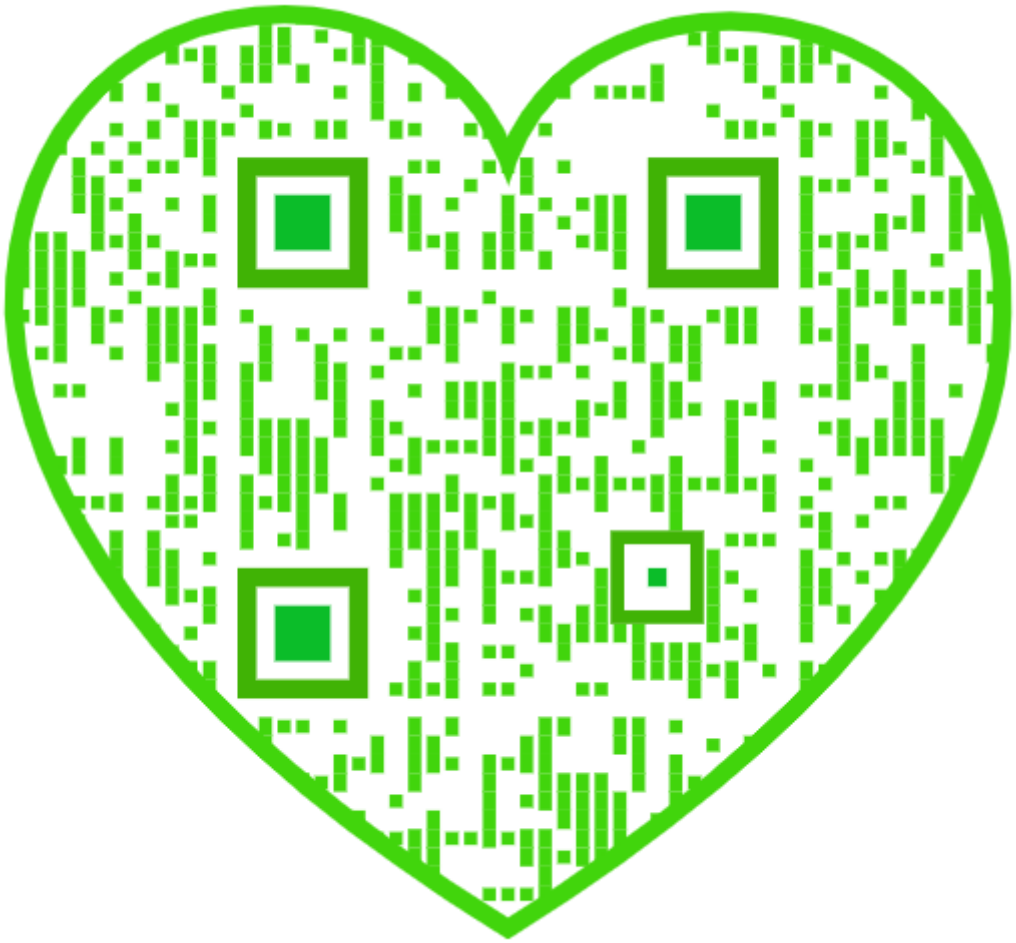
Research and Information Systems Division

Helena, Montana

Frank McChesney
Director

March 14, 1974



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C. R. Draper, Administrator
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Mining operation at Colstrip shows operation of Western Energy Co. Low-sulfur coal seam is removed by loading shovel (foreground) into 100-ton coal hauler. Mounds visible at left and right are being reclaimed.

Introduction

Montana's coal deposits have placed the Big Sky Country in the minds of many Americans as a source to help alleviate the current energy problem.

But what is the size of these deposits? Where do they lie? What is being done with them? What are some of the potentials?

The publication is designed to provide some of the facts regarding the coal deposits and current usages. It is not the intent to speculate about the future or delve into the economic, social or environmental problems, but rather simply to provide some of the basics upon which all the concerns are focused.

Coal Sources

Although coal lies in scattered deposits throughout the State of Montana and has been mined for more than 100 years, by far the greatest amount, and virtually all the coal that can be profitably surface mined with current technology, is found in the eastern third of Montana.

This large coal source forms part of the Fort Union Basin which includes four states of the U.S.A. and a part of the Canadian Province of Saskatchewan. A large number of the deposits lie at shallow depths, and in beds thick enough to be obtained by strip mining. These beds consist of sub-bituminous and lignite rank. The map on page 13 shows the locations of approximately 42 billion tons of coal and lignite in 62 deposits surveyed, tested, and mapped so far by the State Bureau of Mines and Geology. The estimated tonnage does not include some additional 6 billion tons in deposits located on two Indian reservations.

With the map is a table (page 14) showing names, estimated available tonnages, ash, sulfur, and heat content of the coal, and acreages of each deposit surveyed. Relative thickness of the coal seams at depths less than 150 feet is indicated by the fact that these coal fields average nearly 37 thousand tons per acre.

A line on the map indicates where lignite coal, to the north and east, gives way to sub-bituminous ranks in three classifications. The description of the

various ranks, according to the classification system specified by the American Society for Testing Materials, is:

Rank	Calorific Value Limits -- BTU per lb.
Sub-bituminous A	10,500 - 11,500 BTU
Sub-bituminous B	9,500 - 10,500 BTU
Sub-bituminous C	8,300 - 9,500 BTU
Lignite A	6,300 - 8,300 BTU
Lignite B	6,300 BTU or less

It has been pointed out by Groff and Matson of the Bureau of Mines and Geology that although sub-bituminous coal and lignite do not have the thermal value of higher rank bituminous coal, they are present in great abundance and are non-agglomerating. Since they are also more chemically reactive than bituminous, they have process advantages for some of the technologies of coal conversion.

Current Production

Since 1970 the production of coal in Montana by strip mining has increased considerably. The accompanying table shows tonnages for 1971 through 1973, in the four counties where such mining occurs. In the case of Musselshell County, however, except for an experimental effort to surface-mine higher grades of sub-bituminous coal by contour surface mining, the relatively small tonnages are from underground operations.

In 1972 some 8 million tons of coal were mined, virtually all of which was from eastern Montana. In 1973 production neared 11 million tons; and according to the

Montana Energy Advisory Council staff headed by Lt. Governor Christiansen, present contracts for coal to be delivered (assuming that all four planned mine-mouth generators are constructed at the town of Colstrip) will raise production by 1980 to some 40 million tons per year.

TONNAGES OF SURFACE-MINED COAL, BY COUNTY:
MONTANA, 1971, 1972, 1973

County	Number of Tons* Mined		
	1971	1972	1973
Big Horn	(1)	792,949	4,159,287
Musselshell	5,582	8,241	3,291
Richland	325,475	320,975	312,785
Rosebud	6,652,111	7,101,953	6,164,016
MONTANA TOTAL	6,983,168	8,224,118	10,639,379

(1) Decker Coal Company production did not start until 1971.
* 1 short ton = 2,000 lbs.

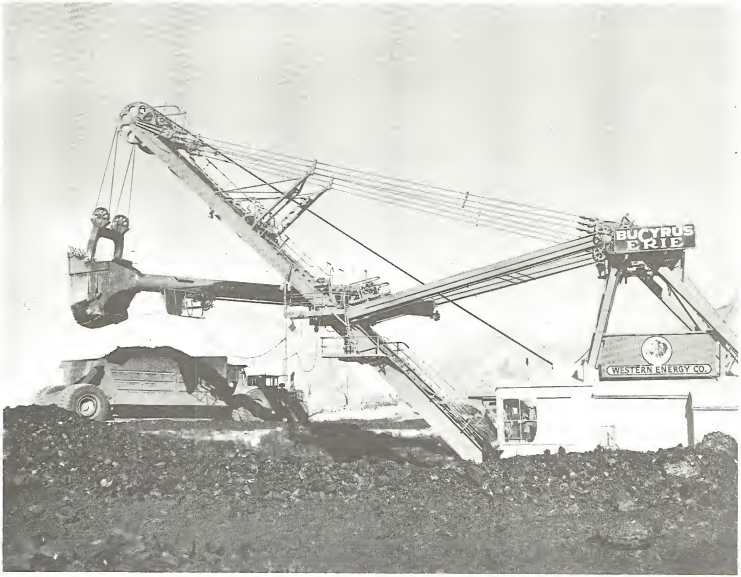
At the present time, surface-mined coal is produced at three of the 62 areas shown in the locations map. These sites are:

No. 1, Decker. The Decker Mine, operated by the Decker Coal Company.

No. 14, Colstrip. Two mines, approximately 5 miles apart, are currently producing coal from the same seams; Western Energy Company at the Colstrip Mine, and the Big Sky Mine operated by Peabody Coal Co.

No. 47, Breezy Flat. The Knife River Coal Co. produces about 320,000 tons per year of lignite for use in a generator operated by the Montana-Dakota Utilities Co., of which Knife River is a subsidiary.

Further information about these and other companies was presented in the September, 1973 issue of Montana Public Affairs, published at the University of Montana by the Bureau of Government Research.



Closeup of coal loading and 17-cubic-yard shovel filling a 100-ton coal loader, which will take its burden to the crusher, conveyor and loading tipple at the railhead.

The Knife River Coal Co., as noted above, produces lignite for the sole use of its parent company, Montana-Dakota Utilities, whose generating plant is at Sidney, Montana.

Western Energy Co. is a wholly-owned subsidiary of the Montana Power Company. Operation began in 1968 when the company took over operation of mines at Colstrip formerly owned and operated by the Northern Pacific Railroad Co. for its coal-fired engines. This company has increased production steadily, reaching more than 5.5 million tons in 1972. Montana Power Company's latest annual report shows that beginning in 1975, long-term contracts will result in further increased production, estimated by the company to reach 12 to 13 million tons by 1980.

Peabody Coal Co. is a subsidiary of Kennecott Copper Company. In 1969 it began producing from the Big Sky Mine in the Colstrip field, shipping 1-1/2 million tons by "unit train" to Minneapolis, under contract to the Minnesota Power and Light Company which uses the coal in its generation plants. Tonnage is expected to increase as a result of additional contracts which, beginning in 1974, will require production of 3-1/2 million tons per year.

Decker Coal Co. is a joint venture of Pacific Power and Light Company of Portland, Oregon, and Peter Kiewit Sons' Company headquartered in Omaha, Nebraska. Coal production by this company began in late 1972 and was approximately 4 million tons in 1973. It is shipped by unit train and barge to Chicago

for use by Commonwealth Edison Company in coal-fire steam-powered generators. Further contracts call for delivery of 180 million tons, or 7 million per year, over a 26-year period to Detroit Edison Company for use in Michigan generation plants beginning in 1976.

Westmoreland Resources Corp. is a four-way partnership between the Westmoreland Coal Company, Kewanee Oil Company, Morrison-Knudsen Company, and the Penn-Virginia Corporation. Its operation is in the Sarpy Creek field (#33 on the map), a 1.5 billion ton deposit located near the creek which gives it its name. It is 35 miles south of the town of Hysham on the Yellowstone River. Although the surface land was not owned by the Crow Indian Tribe, rights to the coal beneath it were, and were obtained by lease from the Tribal Council.

A rail spur to the site is under construction by Burlington Northern Railroad Company. It will be a 36-mile line running south from the main line along the Yellowstone River. Contracts for the coal mined have been negotiated with several mid-western utilities companies, and will be hauled by unit train from the Sarpy Creek, at the rate of approximately 4 million tons per year over a 20-year period, beginning this year.

Much of the land underlain by strippable coal in eastern Montana is owned by the federal government, which has granted leases on considerable acreages in the past. The Bureau of Land Management, however, has placed a temporary moratorium on further leasing of federal lands under its control.

It was reported by the Northern Plains Resources Council (Billings, Montana) that by March 1973, over 601,000 acres of land were under lease in 12 eastern Montana counties. Companies having 50,000 acres or more under lease included Consolidation Coal Company, Norsworthy-Reger, HFC Oil Company, Sentry Royalty Company, Western Energy Company, and Westmoreland Resources, and the list of individuals and corporations holding leases included 40 or more other names.

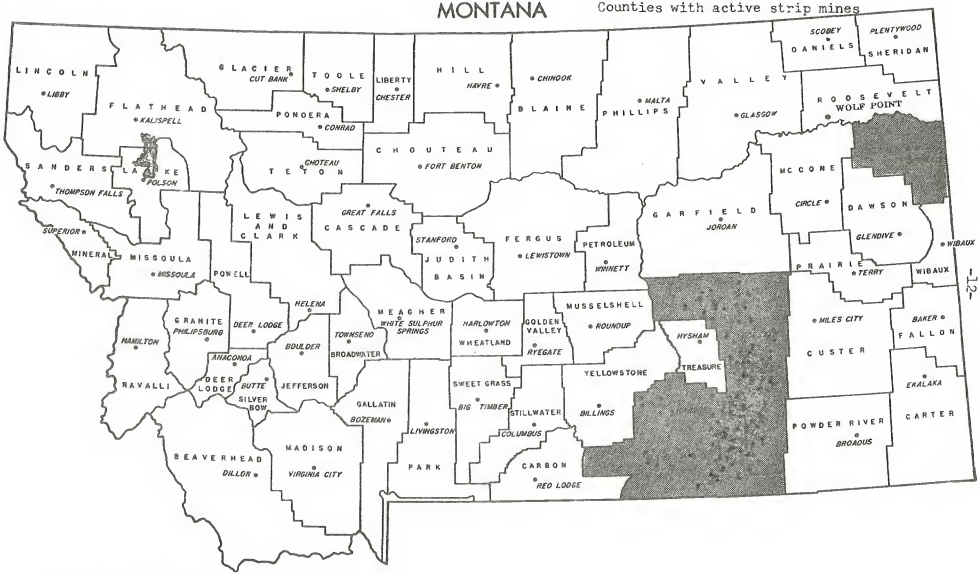
Coal Utilization

All the coal now being produced by surface mining in Montana is slated for power generation. The coal is going either into mine-mouth plants or to other states via unit train shipments. There has been considerable interest, however, in utilization of the coal for chemical conversion, to high-BTU "pipeline quality" gas, "producer gas," coal tars and liquids, and char.

Some of these conversion processes have the advantage over use of coal for power generation, which requires sizeable quantities of water for cooling and boiler feedwater makeup, that they may use relatively small amounts of water. Some of the deposits, particularly of lignite, are said to contain in themselves virtually all the water needed for the chemical reactions. All plants in the state utilizing these technologies will come under the requirements of the State Utility Siting Act, requiring justification for their location.

Reclamation program smoothes out mounds, restores vegetation with native grasses, grains planted on contoured land. Saving of topsoil and placing it back over fill material is a practice of Western Energy. Reclamation is under direction of Montana State University, which was engaged by Western Energy in 1968 before reclamation procedure for land like this had been researched.

Other current state laws require the reclamation of land disturbed by surface mining, and the submission of plans for such reclamation as well as the excavation plan, before a permit to commence mining can be issued. In general, the aim is to assure restoration of the land to the approximate contours it had before the coal was removed, and restocking of the land with vegetation similar to that which it supported before mining began. Experimentation has been underway for several years by the staff of Montana State University on restoration methods upon lands already strip-mined in past years, before regulations required reclamation.



No. 1052 — County Outline Map
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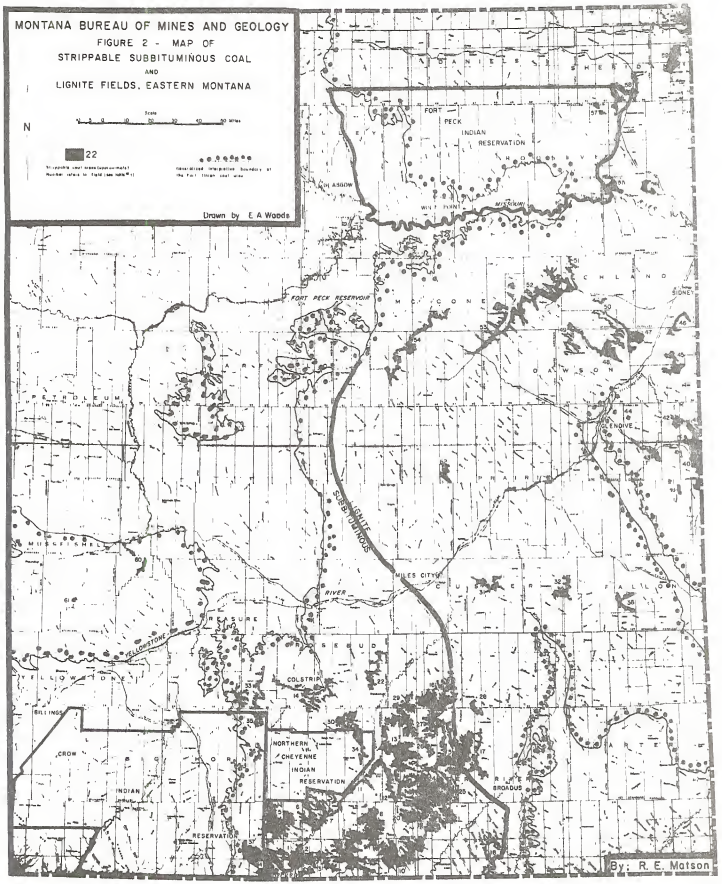
MONTANA BUREAU OF MINES AND GEOLOGY
FIGURE 2 - MAP OF
STRIPPABLE SUBBITUMINOUS COAL
AND
LIGNITE FIELDS, EASTERN MONTANA
N
22
Drawn by E. A. Woods
FORT PECK INDIAN RESERVATION
FORT PECK RESERVOIR
MISSOURI
YELLOWSTONE
MILES CITY
COLSTRIP
BILLINGS
CROW INDIAN RESERVATION
NORTHERN CHEYENNE INDIAN RESERVATION
BROADUS
ROSEBUD
POWDER RIVER
CUSTER
DANIELS
SHERIDAN
VALLEY
PHILLIPS
BLAINE
HILL
CHOUTEAU
LIBERTY
TOOLE
PONDERA
TETON
PETROLEUM
FERGUS
MUSSELSHELL
GOLDEN VALLEY
SWEET GRASS
STILLWATER
CARBON
WHEATLAND
GOLDEN
MEAGHER
GALLATIN
MADISON
BEAVERHEAD
BROADWATER
JEFFERSON
POWELL
LEWIS AND CLARK
JUDITH BASIN
CASCADE
GARFIELD
MCCONE
DAWSON
RICHLAND
WIBAUX
PRAIRIE
FALLON
CARTER
ROOSEVELT
SHERIDAN
MCKENZIE
GLENDIVE
By: R. E. Matson

Table 1. Strippable subbituminous and lignite coal fields, eastern Montana

No. on map	Name of field	Coal bed	Est. reserves in millions of tons	Acreage	Average tons/acre	Ash[1]	Sulfur[1]	Btu[1]
1	Decker	Anderson-Dietz 1&2	2,239.99	25,523	87,763	4.0	.40	9,652
2	Deer Creek	Anderson-Dietz 1&2	495.65	14,214	35,397	4.0	.50	9,282
3	Roland	Roland	218.04	12,076	18,055	9.2	.74	8,164
4	Squirrel	Roland	133.41	6,208	21,490	5.5	.29	7,723
5	Kirby	Anderson	216.52	5,658	38,285	4.2	.32	8,328
		Wall	473.69	5,952	79,579			
		Dietz	834.35	17,516	47,630	5.8	.59	8,509
		Canyon	158.53	4,066	38,983	5.8	.24	8,789
6	Canyon	Wall	1,884.25	23,859	78,974	4.6	.30	9,088
		Brewster-Arnold	65.86	2,067	31,859	7.5	.40	8,444
7	Birney	Brewster Arnold	180.55	6,969	25,905	5.1	.41	9,055
8	Poker Jim Lookout	Anderson-Dietz	872.65	19,609	44,501	5.2	.37	7,925
9	Hanging Woman Cr.	Anderson	1,583.29	30,547	51,830	4.9	.29	8,496
		Dietz	1,120.96	43,654	25,678	5.5	.33	7,718
10	West Moorhead	Anderson	883.74	19,660	44,949	5.3	.36	8,296
		Dietz	397.49	20,416	19,469	4.1	.41	7,990
		Canyon	690.19	22,547	30,611	5.6	.45	8,055
11	Poker Jim O'Dell	Knobloch	373.29	7,890	47,311	5.1	.22	8,846
		Knobloch	564.78	7,187	78,581			
12	Otter Creek	Knobloch	2,035.55	25,791	80,475	4.7	.36	8,468
13	Ashland	Knobloch	2,696.20	27,200	99,125	4.8	.15	8,421
		Sawyer A & C	357.49	20,262	17,643	4.9	.49	7,883
14	Colstrip	Rosebud	1,439.26	33,379	43,118	9.5	.12	8,836
15	Pumpkin Creek	Sawyer	2,426.50	45,695	53,102	7.5	.34	7,438
16	Foster Creek	Knobloch	708.13	27,801	25,470	7.8	.76	7,573
		Terret	460.87	27,462	16,782	5.8	.21	7,770
		Flowers-Goodale	258.90	14,444	17,924	7.8	.51	7,553
17	Broadus	Broadus	739.82	18,429	40,142	7.2	.27	7,437
18	East Moorhead	T	525.21	15,559	33,756	6.2	.57	7,120
19	Diamond Butte	Canyon	418.02	21,363	19,566	4.8	.43	7,330
20	Goodspeed Butte	Cook	628.95	13,446	46,775	10.6	1.63	6,771
21	Fire Gulch	Pawnee & Cook	336.69	8,486	39,674	3.8	.33	7,739
22	Sweeney-Snyder	Terret	326.33	10,921	29,880	9.1	.11	8,175
23	Yager Butte	Elk & Dunning	1,175.86	26,924	43,673	4.8	.33	7,646
		Cook	312.02	14,507	21,507	6.7	.63	7,254
24	Threemile Buttes	Canyon & Ferry	225.40	13,836	16,289	5.5	.94	6,867
25	Sonnette	Pawnee	320.25	8,224	38,940	9.8	.88	6,964
		Cook	362.98	10,470	34,668	8.1	1.33	6,891
26	Home Creek Butte	Canyon & Ferry	217.21	4,851	44,774			
27	Little Pumpkin Creek	Sawyer A&C, D, X, & F	215.83	8,534	25,290			
28	Sand Creek	Knobloch	267.34	5,952	44,915	6.6	.30	7,340
29	Beaver Fiscum	Flowers-Goodale & Terret	138.87	8,851	15,350	8.1	.96	8,102
		Knobloch	491.62	17,075	28,791	7.7	.50	8,027
30	Greenleaf-Miller Creek	Rosebud, Knobloch, and Sawyer	453.71	14,918	30,413	7.8	.71	8,432
31	Pine Hills	Dominy	193.87	6,022	32,191	7.2	.83	7,293
32	Knowlton	Dominy (M & T)	747.51	19,613	38,112	7.1	.41	6,710
		Dominy (U)	120.11	4,448	27,048	5.6	.38	6,645
33	Sarpy Creek	Rosebud-McKay	1,500.00	42,373	35,400	6.5	.50	8,600
34	Cheyenne Meadows	Knobloch	1,200.00	13,560	88,500	4.1	.40	8,400
35	Little Wolf	Rosebud-McKay	314.00	7,411	42,370			
36	Jeans Fork		90.00	3,800	23,685			
37	Wolf Mountains		1,922.00	31,000	62,000			
38	Lame Jones	Dominy	150.00	10,593	14,160			6,020
39	Lamesteer	Harmon(?)	35.00	1,978	17,700			6,332
40	Wibaux	C	643.00	18,518	34,720	7.9	.90	6,050
41	Little Beaver	C	134.00	8,445	15,865			
42	Four Buttes	C	91.00	5,180	17,570			6,140
43	Hodges		10.00	807	12,390			
44	Griffith Creek		10.00	568	17,700			

MONTANA BUREAU OF MINES AND GEOLOGY

Table 1. Strippable subbituminous and lignite coal fields, eastern Montana

No. on map	Name of field	Coal bed	Est. reserves in millions of tons	Acreage	Average tons/acre	Ash[1]	Sulfur[1]	Btu[1]
45	Smith-Dry Creek	G	150.00	8,475	17,700			
46	O'Brian-Alkalie Creek		150.00	8,475	17,700			
47	Breezy Flat	Pust	200.00	7,062	30,090	6.7	.50	6,660
48	Burns Creek	Pust	200.00	7,062	30,090			
49	N.F. Thirteen Mile Creek	Pust	225.00	5,085	44,250			6,880
50	Fox Lake	Pust	46.00	2,166	21,240			6,880
51	Lane	Lane	561.00	44,582	12,390			7,150
52	Carroll	Carroll	345.00	29,780	11,584	5.5	.30	7,400
53	Redwater River	S	642.00	24,181	26,550	6.1	.40	7,400
54	Weldon-Timber Creek	S	724.00	25,565	28,320			7,660
55	Fort Kipp	Ft. Kipp-Ft. Peck	331.00	14,500	22,830	4.6	.20	6,110
56	Lanark	Lanark	100.00	3,531	12,390	6.3	.40	6,853
57	Medicine Lake		58.00	3,740	15,510	7.2	1.00	6,870
58	Reserve		246.00	18,231	13,495	7.6	.40	6,599
59	Coal Ridge	Coal Ridge	150.00	19,200	17,700	7.5	.40	5,830
60	Carpenter Creek	Carpenter	50.00	3,211	14,015	6.5	.40	9,270
61	Charter	Mammoth	60.00	3,210	17,700	6.0	.90	10,190
62	Little Sheep Mtn.	A&C	200.00	10,272	19,470			
		TOTAL	42,561.93	1,152,640				

[1] "As received" basis (where more than one sample available, figures given are average figures).

By Robert E. Matson

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